INSTRUCTION MANUAL

REGATRON

POWER SUPPLY

MODEL 234AM/A

SERIAL No. _____

ELECTRONIC MEASUREMENTS COMPANY, INCORPORATED

EATONTOWN · NEW JERSEY

TELEPHONE: (201) LIberty 2-0300 TWX: (201) 542-2273 CABLE: ELMEASCO

Warranty

Electronic Measurements instruments are guaranteed to be free from defects in material and workmanship for one year from the date of purchase (except for tubes, fuses and batteries). Our liability under this warranty is limited to repairs and adjustments or replacements of defective parts or instruments when the fault is a direct result of defective materials or workmanship in the manufacture of the apparatus. This warranty covers service for the first year, except for transportation to and from the factory. If any fault develops in the equipment, the following steps should be taken:

1. Notify ELECTRONIC MEASUREMENTS CO., INC. Give full particulars of the difficulty and include the serial number of the instrument in question. On receipt of this information, we will give you service information or shipping instructions.

2. On receipt of shipping instructions, forward the appartus to us, prepaid, and we will make repairs and adjustments immediately at the factory.

3. If the fault has been caused by misuse, or abnormal conditions of operation, as disclosed by our examination, repairs will be billed at cost. In this case, an estimate of the cost will be submitted before work is started.

ELECTRICAL STANDARDS

All company primary standards are either certified directly or are traceable to certification by the National Bureau of Standards.

CLAIM FOR DAMAGE IN SHIPMENT

This instrument received comprehensive visual and electrical inspections before shipment. Immediately upon receipt from the carrier, and before operation, this instrument should be inspected visually for damage caused in shipment. If such inspection reveals internal or external damage in any way, a claim should be filed with the carrier. A full report of the damage should be obtained by the claim agent and this report should be forwarded to us. We will then advise you of the disposition to be made of the equipment and arrange for repair or replacement. When referring to this instrument, always include the model and serial numbers.

REGATRON

PROGRAMMABLE

POWER SUPPLY

MODEL 234A

Serial No._____

Issued: March 1961

WARRANTY

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If, during subsequent service, any fault develops in the equipment, the following steps should be taken:

1. Notify ELECTRONIC MEASUREMENTS CO. INC., giving full particulars of the difficulty and include the serial number of the instrument in question. On receipt of this information, we will give you service information or shipping instructions.

2. On receipt of shipping instructions, forward the apparatus to us, prepaid, and we will make repairs and adjustments immediately at the factory.

3. If the fault has been caused by misuse, or abnormal conditions of operation, as disclosed by our examination, repairs will be billed at cost. In this case, an estimate of the cost will be submitted before work is started.

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Electronic Measurements Company Inc.

Eatontown, New Jersey

REGATRON POWER SUPPLY
TABLE OF SPECIFICATIONS
MODEL 234A

OUTPUT
0 to 300 volts, 0 to 500 milliampere

REGULATION
LINE: 0.08% or 0.05 volts, whichever is greater, for line change from 105 to 125 volts ac, 50-60 cps.
LOAD: 0.02% or 0.04 volts, whichever is greater, no load to full load.

REGULATION WITH CHOPPER STABILIZATION
LINE OR LOAD: 0.01% or 3 millivolts, whichever is greater.

STABILITY: Within 0.1% or 50 millivolts, whichever is greater, for 8-hours after 30-minute warmup under fixed line, load, and temperature conditions, and using precision high-stability external programming resistor.

STABILITY WITH CHOPPER STABILIZATION: 0.05% + 2 millivolts, same as conditions above.

RIPPLE: 1 millivolt RMS maximum with positive or negative output grounded.

OUTPUT IMPEDANCE: Less than .01 ohm at low audio frequencies; 0.1 ohm to 10 KC; 1 ohm to 40 KC.

TRANSIENT RESPONSE: For step change from no load to full or full to no load, output recovers to within dc regulation limits of initial value within 1 millisecond.

PROGRAMMING CONSTANT: 1000 ohms-per-volt of output.

REMOTE SENSING: Panel terminals permit sensing of positive and negative output leads.

AMBIENT TEMPERATURE RANGE: -20°C to +45°C.

OUTPUT GROUND: Positive, negative or floating output.

CIRCUIT PROTECTION: Input ac line fused, dc output fused.

TERMINATIONS: Front:5-way insulated binding posts. Rear: barrier-type terminal strips. Line cord is 3-conductor type.

CONTROLS: Main voltage control and vernier are wirewound. Panel calibration is approximate.

MOUNTING: Unit fits 19" standard racks and is equipped with rubber feet for table mounting. Top and bottom are protected by perforated metal covers.

FINISH: Smooth gray semi-gloss enamel Class 2 per MIL-E-15090.

INPUT POWER REQUIRED: 438 watts.

DIMENSIONS: 7 inches high, 11½ inches deep, 19 inches wide.

WEIGHT: 41 pounds, approximately.

SECTION I

INTRODUCTION

1. DESCRIPTION:

The Programmable REGATRON is a new type of power supply designed to meet the need for remote control arising out of the increasing tendency towards automation, centralized control, etc. The word, "programmable" has been coined to indicate the fact that the unit may be controlled or "programmed" from a remote or central point. In the design this has been made possible by very simple means, so that the proper control or programming function can be readily incorporated in automatic switching devices.

The circuitry developed for this application embodies a null-balance arrangement which provides unprecedented performance and stability at relatively low cost. Many novel features enhance the usefulness of this unit for general purpose applications.

2. INSPECTION:

After unpackaging the unit, inspect the tubes to see that they are securely in their sockets. Enclosed units may be inspected internally by removing the cover screws and sliding the cover backwards.

II. INSTALLATION

1. POWER:

This unit requires a source of 105 to 125 volts ac at 50 to 60 cps.

2. PLACEMENT:

Cabinet units may be placed on a flat surface on the rubber feet provided. Rack units may be located in the same fashion or attached to a rack panel having standard rack drilling. When placing the unit in position, ventilation openings should be left clear. If mounted in a rack, this consideration should be kept in mind.

III. OPERATION

WARNING

Lethal voltages appear at the output terminals and at various points within the unit. In operation, great care should be observed to avoid accidental contact with any exposed load connections or leads. Load connections should be made with the power off.

1. PRELIMINARY:

General Purpose Use: This unit may be used as a general purpose power supply. To so employ it, proceed as follows:

a. Place the switches and controls in the following positions:
   (1) Line and high voltage switches - off (down).
   (2) H.V. control and vernier - Minimum (counterclockwise).
   (3) Bias control - Minimum (counterclockwise).
   (4) Local remote switch - Local.

b. Make load connections to the binding posts at the front of the unit. The grounded post should securely compress the connecting device or lead as well as the grounding link.

c. Plug the line cord into an outlet providing 115 volts ac at 50 to 60 cycles. Operate the line switch to the "on position (green indicator will glow).

d. Wait one minute and apply voltage to the load by operating the high voltage switch to the on position (up). This will be indicated by the red indicator light.

2. ADJUSTMENT OF VOLTAGES:

All the panel controls are approximately calibrated, hence voltages can be set approximately without the use of meters.

High Voltage and Vernier Controls: These controls may be set in the obvious manner except that the output voltage will be the sum of both readings; thus the vernier will add from 0 to 30 volts at any point in the range. If a high order of stability is required for voltages below 30 volts, the main control may be left at zero and the vernier used alone.

3. REVERSAL OF POLARITY:

This power unit has been designed so that either side of the high voltage may be grounded to the case as desired. The unit is normally supplied with the negative side grounded. To reverse polarity, loosen the three (3) high voltage binding posts, swing the link to the other post, and retighten the two (2) posts on the link. The load connection for the ground side may be inserted eithe under the ground post or the grounded terminal.

Note: For local use the black REM post may be used as an additional negative terminal and the red REM post may be used as an additional positive terminal.

4. PROGRAMMING:

Note: Production units are normally calibrated to make panel calibrations approximately correct. Thus, depending on the tolerance of the internal potentiometer, the calibration may be somewhat more or less than 1,000 ohms-per-volt. Accordingly, if precisely 1,000-ohms-per-volt is desired for programmed use, one of the following will be necessary:

(a) Call for 1,000-ohms-per-volt calibration when ordering.

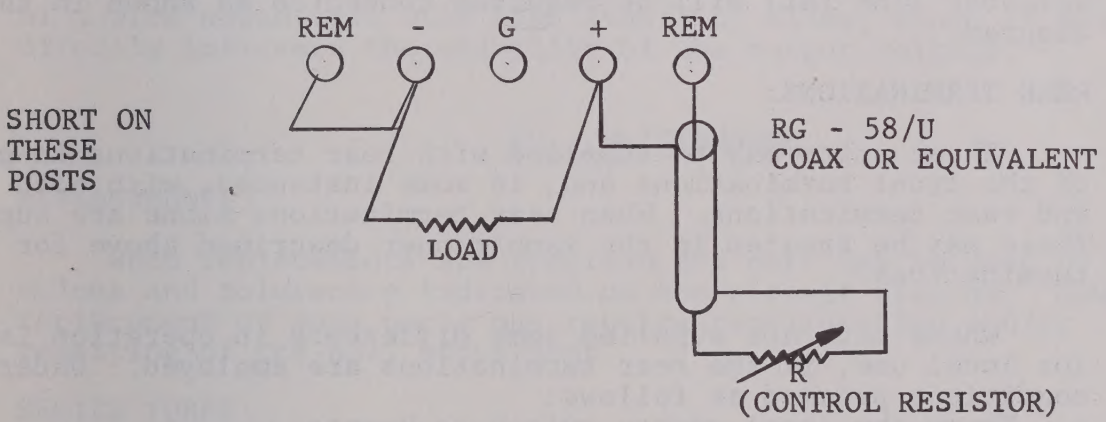
(b) Recalibrate in the field (see below).

Two modes of operation are possible in programming this unit. They will be described in order of the most probable usage below.

MODE 1:

This method provides programming without load sensing; therefore, the length of leads between the terminal posts and the load will influence the amount of voltage drop.

a. Throw the local remote switch to REM and make connections as indicated below. Make certain that the outer sheath of the coax line is connected to the plus output post.



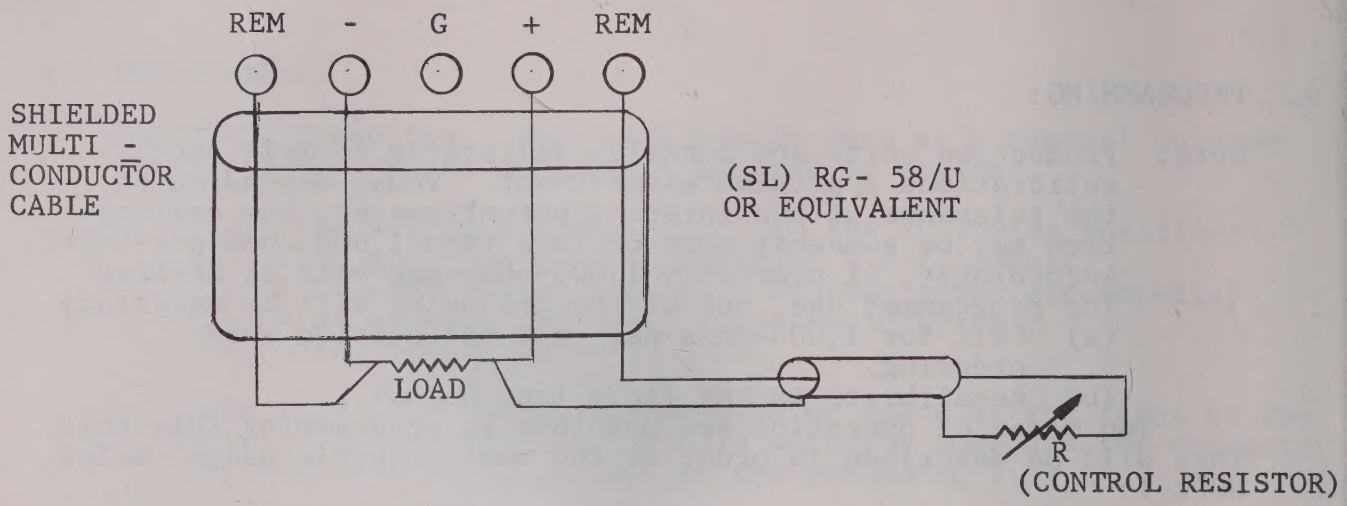
b. Set the high voltage and vernier controls to zero.

c. For each 1,000 ohms of programming resistance 1 volt will be developed by the power supply.

MODE 2:

This method of operation provides sensing at the load and eliminates the effect of lead drop.

a. Make connections as shown on following page.



b. Set the high voltage and vernier controls to zero.
c. As above, one volt will be developed for each 1,000 ohms of programming resistance.

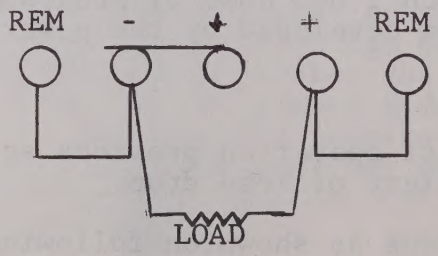
The programming resistance R can be employed close to the lo in which case no shielded line will be required. It may also be located remotely from load and power supply, in which case a shielded line (SL) will be required connected as shown in the diagram.

5. REAR TERMINATIONS:

These units may be supplied with rear terminations in place of the front terminations and, in some instances, with both front and rear terminations. When rear terminations alone are supplied these may be treated in the same manner described above for front terminations.

Where both are supplied some difference in operation is invo for local use, if the rear terminations are employed. Under thes conditions proceed as follows:

a. Throw the local remote switch to Remote:
b. Place two jumpers on the rear terminals as indicated in the diagram below.



For remote use either set of terminals may be employed in th normal manner. Control will then be derived from the particular set of terminals in use.

6. EXTERNAL REFERENCE:

Reference glow tubes experience a progressive change of voltage with time. For example, a typical change is 1/2% for 1,000 hours of use. Where a highly precise reference voltage is available (negative with respect to the negative bus of the power supply) it may be employed in place of the internal reference by connecting to the terminals provided at the rear for this purpose. To do this proceed as follows:

a. Remove the connections across Terminals 1 and 2.
b. Connect the external reference voltage to Terminals 2 and 3 with the positive side of the external reference connected to Terminal 3.

Any reference voltage of 85 volts or more may be used; however, for each volt over 87 volts, provided by the external reference, 1,000 ohms of resistance should be inserted in the line between the reference potential and the external reference terminal on the unit. For example, if a reference of -150 volts is available, a resistor of 63,000 ohms, ± 1% should be provided. This resistor should be of a wire-wound type with high stability alloy, since it will directly influence the stability of the output voltage.

IV. MAINTENANCE

1. REPLACEMENTS:

When replacements are required any part may be used of the values and tolerances indicated on the circuit diagram. However, replacement of some parts may require recalibration and/or resetting of the null adjustment.

2. SERIES TUBES:

The following instructions apply for units having one or more series tubes. If, at any time, it is believed that one or more series tubes and associated circuits are faulty, this may be checked as follows:

a. Remove all series tubes but one.
b. Turn the equipment on and apply a load of 70 ma. at 300 volts. Check ripple and regulation.
c. Remove this series tube and place another series tube in another socket and repeat b.
d. Repeat b for every other socket and tube, taking one (1) at a time.
e. If one or more of the circuits shows faulty, repeat the test in each case using a tube known to be good.
f. If a favorable result is obtained, it may be taken that the previous tube is faulty. If not, the associated circuits should be checked for faults.

3. NULL-BALANCE ADJUSTMENT:

This unit employs a bridge configuration in the control system. When the system is balanced the principal remaining error is that due to the reference element (an 85A2 reference tube). To null the system, proceed as follows:

a. Connect a voltmeter having a full scale sensitivity of 3 volts or less between the negative high voltage terminal and the null test point on the front panel. Set the null control to obtain a reading of zero. A more sensitive indication may be obtained by alternately connecting and disconnecting the voltmeter.

4. CALIBRATION:

If it is desired to calibrate this unit for programmed operation, proceed as follows:

a. Set up to measure the output voltage either with a precise voltmeter or by a comparison method against an external standard.
b. Perform the null-balance adjustment.
c. Obtain a resistance (R) of a value to provide a good on scale reading for the voltmeter, or equal, to the standard potential available.
d. Connect the unit for programmed operation under MODE 1 above using the available resistance as the programming resistor R.
e. Set the calibration control to obtain the correct voltage.
Note: The procedure for calibration of panel controls is self-evident.

ELECTRONIC MEASUREMENTS CO. INC. ADDENDUM #2014

PARTS LIST CHANGE

MODEL 234A/AK
ISSUED 6/61

10-10-61	Change the following components to read:		
	J1 Tip jack, nylon, black	105-603	E.F. Johnson
	J3 Change Part No. to	9977	Cinch-Jones
	XV10-XV16 Socket, 8 pin, octal	9751-9	Eby
8-20-62	Diode(s), germanium, 1N34A, change to diode, silicon	HC-69	Solitron
8-21-62	(add) RT-1, Ballast tube (234A)	AMP 3-4	Amperex

MODELS 234A/234AM - 234AK/234AMK PROGRAMMING CONSTANT: 1000 ωPV

REFERENCE SYMBOL	DESCRIPTION	TYPE OR PART NO.	MANUFACTURER
B1	Motor, shaded pole, 115V, 50-60 CPS, 4 in. fan blade	DYAB-570-3	Barber-Colman
C1,2	Capacitor, electrolytic, 120 UF, 450 VDC, insl. sleeve	D32346	Sprague
C3,4,5,10	Capacitor, electrolytic, 80 UF, 450 VDC, insl. sleeve	D15911-6108	Sprague
C6	Capacitor, mica, 15 UUF ±5%, 500 VDC	CM20B-150-J	Micamold
C7	Capacitor, mica, 220 UUF ±5%, 500 VDC	CM20B-221-J	Micamold
C8	Capacitor, electrolytic, 25 UF, 25 VDC, insl. sleeve	KE-25/25	Frako
C9	Capacitor, molded, 0.5 UF ±20%, 600 VDC	IMP-0.5/600	Pyramid
CORD	Cord set, 7' lg. #18 gauge, 3 cond, 3 prong plug	346-B-52	EMC
CR1-CR8,CR13	Rectifier, silicon	CER-71	Solitron
CR9,10,11	Rectifier, selenium	8J1	Radio Receptor
CR12	Diode, germanium	1N34A	Sylvania
DS1,2	Bulb, 6.3V, 0.25A	44	G.E.
DS3	Bulb, neon	NE-2	EMC
E1,2	Post, binding, red	29-3R	Grayhill
E3,4,5	Post, binding, black	29-3B	Grayhill
E6	Shorting link	938-L	General Radio
E7	Shorting link	141-J	Cinch Jones
F1	Fuse, cartridge, 5A	3AG5	Sightmaster
F2	Fuse, cartridge, ½A	3AG½	Sightmaster
J1	Tip jack, nylon, red	105-603	E.F. Johnson
J3	Socket, 8 pin, octal (stabilizer connector)(234AK/AMK models)	9751-9	Cinch Jones
M1	Milliammeter, 0-500 MADC ±2% accuracy full scale	Model 649/MA500	EMC
M2	Voltmeter, 0-300 VDC ±2% accuracy full scale	Model 649/V300	EMC
R1,2	Resistor, fixed, comp, 82Kn ±10%, 2W	HB-8231	Allen-Bradley
R3	Resistor, fixed, comp, 4.7megn ±10%, ½W	EB-4751	Allen-Bradley
R4	Resistor, fixed, comp, 1megn ±10%, ½W	EB-1051	Allen-Bradley
R5	Resistor, fixed, comp, 1Kn ±10%, 2W	HB-1021	Allen-Bradley
R6	Resistor, fixed, WW, ceramic, 4Kn ±5%, 10W	'Koolohm'10KT4K	Sprague
R7	Resistor, fixed, comp, 3.6Kn ±5%, 1W	GB-3625	Allen-Bradley
R8	Resistor, fixed, comp, 5.6Kn ±5%, 1W	GB-5625	Allen-Bradley
R9,15	Resistor, fixed, comp, 330Kn ±10%, ½W	EB-3341	Allen-Bradley
R10	Resistor, fixed, comp, 390Kn ±10%, ½W	EB-3941	Allen-Bradley
R11	Resistor, fixed, comp, 5.1Kn ±5%, 1W	GB-5125	Allen-Bradley
R12	Resistor, fixed, WW, vitreous enamel, 10Kn ±5%, 20W	Type'Brown Devil'	Ohmite
R13,14	Resistor, fixed, comp, 100Kn ±10%, ½W	EB-1041	Allen-Bradley
R16	Resistor, variable, WW, 30Kn ±5%, 3W, linear taper, ¼ in. dia., ¼ in. lg. shaft, series 58	CM22196	Clarostat
R17	Resistor, variable, WW, 300Kn ±2%, 8W, linear taper, 3/8 in. dia., insl. shaft	976-S11	General Radio
R18	Resistor, fixed, WW, 3Kn ±1%, ½W	Type TX-178	Precision
R19	Resistor, fixed, WW, 76Kn ±1%, 3W	Type P3W	Precision
R20	Resistor, variable, WW, 10Kn ±5%, 2W, linear taper, ¼ in. dia., 1/8 in. lg. slotted shaft, series 43	CM18924	Clarostat
R21	Resistor, fixed, comp, 220Kn ±10%, 1W	GB-2241	Allen-Bradley
R22	Resistor, variable, WW, 3Kn ±5%, 2W, linear taper, ¼ in. dia., 1/8 in. lg. slotted shaft, series 43	CM18923	Clarostat
R23	Resistor, fixed, comp, 150Kn ±10%, 1W	GB-1541	Allen-Bradley
R24	Resistor, fixed, WW, 1n ±5%, 1W	Type BT-1	Int'l Resistance
R25,28,31,34,37, 40,43	Resistor, fixed, comp, 82n ±10%, 1W	GB-8201	Allen-Bradley
R26,29,32,35,38, 41,44	Resistor, fixed, comp, 470n ±10%, 1W	GB-4711	Allen-Bradley
R27,30,33,36,39, 42,45	Resistor, fixed, comp, 47n ±10%, 1W	GB-4701	Allen-Bradley
R46	Resistor, fixed, WW, vitreous enamel, 60Kn ±5%, 25W	0225	Ohmite
R47	Resistor, fixed, WW, vitreous enamel, 3n ±5%, 25W	25F3	Ward Leonard
R48	Resistor, fixed, comp, 4.7n ±5%, 1W	GB-47G5	Allen-Bradley
S1	Switch, toggle, SPST	160-73	Carling Electric
S2	Switch, toggle, TPDT	HL233-73	Carling Electric
S3	Switch, toggle, DPST	2BK-62-73	Carling Electric
T1	Transformer, filament & power	5032	EMC
TB1	Barrier strip, 3 terminal	3-141-Y	Cinch Jones
TB2	Barrier strip, 5 terminal (rear termination only)	5-141-Y	Cinch Jones
V1,3	Electron tube	0A2	RCA
V2,4	Electron tube	0B2	RCA
V5	Electron tube	85A2/0G3	Amperex
V6	Electron tube	6AU6	RCA
V7,8	Electron tube	EM10	EMC
V9	Electron tube	12AY7	G.E.
V10-V16	Electron tube	6550 or KT88	Tung-Sol British Ind.
XDS1	Holder assembly, pilot bulb, green faceted lens	100	Drake Mfg.
XDS2	Holder assembly, pilot bulb, red faceted lens	100	Drake Mfg.
XF1,2	Extractor post, fuse, miniature	342003	Littelfuse
XV1-XV6	Socket, 7 pin, miniature	53P24022	Cinch Jones
XV9	Socket, 9 pin, noval	14502	Cinch Jones
XV10-XV16	Socket, 8 pin, octal	9751-9	Cinch Jones
V9	Electron tube (234A/234AM models)	12AX7	RCA

REVISIONS					
REV	DESCRIPTION	DATE	BY	CHK	APP
D	REDRN	1-5-61	SG		
E	REV. DWG. PER. ECO 138	6-12-61	PWG		
F	REV. PER ECO. NO. 0376	8-20-62	EC.		
G	REV. PER ECO. NO. 0417	11-2-62	RJ		

LINE CIRCUIT FOR 220V INPUT

NOTES:

1. UNLESS OTHERWISE NOTED:
   ALL RESISTANCE VALUES IN OHMS.
   ALL CAPACITANCE VALUES IN MICROFARADS.
   ALL RESISTORS ARE 1/2 W.
   K=1,000 OHMS; M=1,000,000 OHMS.
2. METERS SUPPLIED WITH MODEL 234AM ONLY.
3. ⊘ SCREWDRIVER ADJ ON FRONT PANEL.
4. ▭ DENOTES EQUIPMENT MARKING.
5. TB2 IS SUPPLIED ONLY ON UNITS WITH REAR TERMINATIONS.
6. ON UNITS WITHOUT CONTROLS, VERNIER R16 & D.C. CONTROL R17 ARE REMOVED & CONNECTION MADE DIRECTLY FROM PIN 2 OF V9 (12AX7) TO THE + REM TERMINAL.

DRAWN BY SG 1/3/61	SCHEMATIC DIAGRAM	ELECTRONIC MEASUREMENTS COMPANY, INCORPORATED EATONTOWN, NEW JERSEY	
CHECKED BY PWG 1/16/61	MODEL 234A, 234AM	SIZE D	DWG. NO. 342-D-1 REV. G
DESIGNER		SCALE	WT.
ENGINEER EJD 1/16/61		SHEET	OF SHEETS
APPROVED BY			